



COLD PRESSOR TEST USED FOR SCREENING OF RISK OF HYPERTENSION IN FIRST BLOOD RELATIONS OF KNOWN HYPERTENSIVES

Dr Amit Kumar

Assistant Professor, Dept. of Physiology, Adesh Medical College and Hospital, Shahabad(M)

Dr Rashmi*

Assistant Professor, Dept. of Physiology, Adesh Medical College and Hospital, NH-1, Mohri, Shahabad(M), Near Ambala Cantt-136135 *Corresponding Author

ABSTRACT

Introduction: Hypertension is modern day's serious health problem which is very common in first blood relations of known hypertensives. It may lead to adverse cardiovascular complications if proper attention is not given.

Aims and Objectives: Present study aims to record the blood pressure in response to Cold Pressor Test in first blood relations of known hypertensives in age group of 18-40 years. Age matched normotensives would serve as controls. This study would help in early detection of hypertension in such subjects and initiate control measures to prevent development of cardiovascular disease in future.

Material and Methods: Resting Blood Pressure was recorded in all subjects (n=100) by auscultatory method. Cold Pressor Test was performed in 50 subjects who are first blood relations of known hypertensives (n=50), and results compared with age matched first blood relation of normotensives (n=50), who will serve as Control group. Changes in systolic and diastolic blood pressures were noted after cold pressor test.

Results: Increase in systolic blood pressures were highly significant and increase in diastolic blood pressures were significant after Cold Pressor Tests in first blood relations of known hypertensives.

Conclusion: Present study will help to screen first blood relations of hypertensives and see if they are more prone to develop early hypertension so that proper control measures can be initiated in them in order to prevent cardiovascular complications in future.

KEYWORDS : Cold Pressor Test, Hypertension, Autonomic function Tests

INTRODUCTION

Hypertension is defined as any one of the following: systolic blood pressure ≥ 140 mmHg, diastolic blood pressure ≥ 90 mmHg, taking anti-hypertensive medications^{1,2}. Rapid change in modern day lifestyles like sedentary lifestyles, junk foods, low intake of fruits and vegetables, increased tobacco use, stress, poor sleep etc. associated with environmental factors like rapid urbanization and industrialization are powerful risk factors for increasing prevalence of hypertension, especially in younger age groups, which may lead to adverse cardiovascular complications if not diagnosed early and proper attention is not given^{3,4}.

The Global Burden of Disease Study estimate of age-standardized cardiovascular death rate of 272 per 100000 population in India is higher than the global average of 235 per 10000 population⁴. As hypertension is controllable, an early diagnosis and control can prevent 300000 of the 1.5 million deaths which results from cardiovascular disease in India⁵.

Blood Pressure is under Autonomous Nervous System control. Cold Pressor Test is a simple and non-invasive test of sympathetic activation.

Cold pressor test by Hines and Brown⁶ is used in the present study which is based on the fact that immersion of hand in ice cold water causes sympathetic stimulation which can cause increase in Blood Pressure due to massive release of nor-epinephrine.

Subjects in whom systolic blood pressure had increased by 25 mm Hg or more, or in whom diastolic blood pressure had increased by 20 mm Hg or more after cold pressor test were considered to be hyper-reactive. Those subjects in whom rise in systolic blood pressures was less than 25 mm Hg and rise in diastolic blood pressures was less than 20 mm Hg were considered as normo-reactors.

MATERIALS AND METHODS

The study was approved by institutional ethics committee. A written consent of every subject was taken before performing examination. The present case control study was conducted in Department of

Physiology, Adesh Medical College and Hospital, Shahabad, Haryana, on attendants of patients attending the OPD of Adesh Medical College and Hospital, Shahabad, Haryana. Subjects (n=100) in age group of 18-40 yrs were included in the study. 50 subjects who are first blood relations of known hypertensives attending Adesh Medical College and Hospital OPD will serve as Study group, and results compared with age matched 50 first blood relation of normotensives, who will serve as Control group.

With subjects mentally and physically relaxed, Blood Pressures of all subjects were measured by auscultatory method with aneroid sphygmomanometer in sitting position. Subjects were instructed about the procedure beforehand. Subjects were also instructed that they should remove their hands immediately from cold water if it causes pain, and not wait for the test to be over.

Resting blood pressure of each subject was taken before the procedure in sitting position. For Resting Blood Pressures three readings were taken and maximum of the three readings was noted⁷. With the cuff of sphygmomanometer in position in the dominant hand, the non-dominant hand of the subject would be immersed in cold water up to wrist⁸ crease, preferably at temperatures of 4-6 °C⁹ for a period of exactly 2 minutes¹⁰. Blood Pressure was recorded in dominant hand immediately after 2 minutes with non dominant hand immersed in cold water. Hand would be removed from the cold water after Blood Pressure recording is complete. If the procedure causes pain, test may be reduced to 1 minute, or hands may be removed even earlier from cold water if it causes pain.

Systolic and diastolic pressures were recorded after Cold Pressor Response and compared with pre-test readings (baseline readings). The results were analyzed statistically and interpreted.

Exclusion criteria

Subjects having history of cardio respiratory disease, Diabetes Mellitus, bronchial asthma, anaemia, chronic blood loss due to any cause, subjects who are addicted to alcohol, smokers and subjects engaged in regular physical exercises or with history of any chronic diseases were excluded from the study.

Observations**Table 1: Resting Blood Pressures (Before hand Immersion) in First Blood Relations of known Hypertensives and Normotensives:**

Vitals	Hypertensive 1 st Relation (Study Group)	Normotensive 1 st Relation (Control Group)
Systolic Blood Pressure (mm Hg) Mean ± SD	114.32 ± 10.92	112.44 ± 7.96
Diastolic Blood Pressure (mm Hg) Mean ± SD	82.1 ± 10.47	78.82 ± 8.21

Table 3: Comparison of Blood Pressures in First Blood Relations of known Hypertensives and First Blood Relations of known Normotensives: (All Blood Pressure recordings are in mm Hg)

Parameters	Resting SBP (Mean ± SD)	SBP After hand immersion / CPT Test (Mean ± SD)	Difference of Systolic Blood Pressures	Resting DBP (Mean ± SD)	DBP After hand immersion / CPT Test (Mean ± SD)	Difference of Diastolic Blood Pressures
Hypertensive 1st Blood Relations	114.32 ± 10.92	138.4 ± 12.47	24.08 ± 10.12	82.1 ± 10.47	94.12 ± 11.82	12.02 ± 8.46
Normotensive 1st Blood Relations	112.44 ± 7.96	130.22 ± 11.92	17.78 ± 9.12	78.82 ± 8.21	86.62 ± 8.72	7.8 ± 7.25
'p' value	0.577	0.0003	0.0015	0.14	0.018	0.03
Significance levels	Non Significant	Highly Significant	Highly Significant	Non Significant	Significant	Significant

'p'<0.05 = significant

'p'<0.001 = highly significant

'p'>0.05 = non-significant

Our result showed that Initial Resting Systolic Blood Pressures and Diastolic Blood Pressures between 1st blood relations of hypertensives (study group) and normotensives (control group) were statistically non-significant ($p > 0.05$). But SBP was highly significant ($p < 0.001$) and DBP was significant ($p < 0.05$) after immersion of hand in cold water (after Cold Pressor Test) when study groups were compared with control group. Also increase in SBP was highly significant and increase in DBP was significant after Cold Pressor Test when study and control groups were compared with each other. This showed that Systolic Blood Pressure was affected more than Diastolic Blood Pressures after hand immersion in cold water.

DISCUSSION

Cold Pressor Test is based on the fact that the immersion of hand in ice cold water causes sympathetic stimulation which can cause increase in Blood Pressure due to massive release of nor-epinephrine.

Sympathetic stimulation causes increased myocardial contractility and force of contraction of the heart, accompanied by increased heart rate which leads to increase in cardiac output which in turn causes increase in Systolic Blood Pressure.

Sympathetic stimulation also leads to increased arteriolar constriction which leads to increase in peripheral resistance which in turn leads to increase in Diastolic Blood Pressure.

Blood Pressure is under Autonomous Nervous System control. Sympathetic over activity is a major factor demonstrated in otherwise normotensives first blood relations of hypertensives^(11, 12). Early detection of the autonomic changes in first blood relations of hypertensives can be done by application of various physical stress tests. The stress used in this study is Cold Pressor Test where cold water acts as a painful stimulus for stress. Exposure to stress increases sympathetic outflow, and stress induced vasoconstriction may result in vascular hypertrophy, leading to progressive increase in peripheral resistance and blood pressure¹³.

Cold pressor test gives indication of Left Ventricular Function¹⁴ and cardiac autonomic function¹⁵ Test.

Several other works done by different authors had reported similar results viz works done by Ashwini et al¹⁶, Verma et al¹⁷ and Sonia Garg et al¹⁸.

Table 2: Blood Pressures (After hand Immersion) in First Blood Relations of known Hypertensives and Normotensives:

Vitals	Hypertensive 1 st Relation (Study group)	Normotensive 1 st Relation (Control Group)
Systolic Blood Pressure (mm Hg) Mean ± SD	138.4 ± 12.47	130.22 ± 11.92
Diastolic Blood Pressure (mm Hg) Mean ± SD	94.12 ± 11.82	86.62 ± 8.72

However work done by Germano et al¹⁹ showed contradictory results.

CONCLUSION

The present study will help to screen the first blood relations of known hypertensives and see if they are more prone to develop early hypertension so that proper control measures can be initiated in them in order to prevent cardiovascular complications in future.

REFERENCES

- Harrison's Principles of Internal Medicine, Mc Graw Hill Education/19th Edition, 2015. Hypertensive Vascular Disease: chapter 298:1612
- The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.
- Das SK et al. Study of urban community survey in India: growing trend of high prevalence of hypertension in a developing country: Int J Med Sci. 2005;2:70-78.
- Dorairaj Prabhakaran, Jeemon P, Ambuj Roy. Global Burden of Cardiovascular Disease: Current Epidemiology and Future Directions. Circulation. 2016; 133:1605-1620.
- Gupta R. Hypertension epidemiology in India: lessons from Jaipur heart watch. Current Science. 2009;97:3.
- Hines EA, Brown GE. The Cold Pressor Test for measuring the reactivity of the Blood Pressure: data concerning 571 normal and hypertensive subjects. Am Heart J. 1936; 11(1):1-9. DOI:10.1016/S0002-8703(36)90370-8.
- Ghai CL. Practical Physiology/8th Edition:173.
- Brownlee M, Lloyd A.P., Cooper M.E. et. al.(2008). Complications of diabetes mellitus, in Williams textbook of Endocrinology Kronenberg H.M., Melmed S., Polonsky K.S., Larsen P.R. eds, Philadelphia, saunders. 1473-1474.
- Reiser MF, Ferris Jr EB. The nature of the cold pressor test and its significance in relation to neurogenic and humoral mechanisms in hypertension. J. Chin Invest 1948;27:156-163.
- A.K. Jain. Manual of Practical Physiology /4th Edition:291
- Ganong. Cardiovascular Regulatory Mechanism: Review of Medical Physiology/ McGraw Hill Medical Publishers/23rd Edition, Chapter 33.
- Gianfranco Parati, Murray Esler. The human sympathetic nervous system: its relevance in hypertension and heart failure. European Heart Journal. 2012.
- Oparil S, Zaman MA, Calhoun DA (November 2003). "Pathogenesis of hypertension". Ann. Intern. Med. 139(9):761-76. DOI:10.7326/0003-4819-139-9-200311040-00011.
- Northcote RJ, Cooke MB. How useful are the Cold Pressor Tests and sustained Isometric handgrip exercise with Radionuclide ventriculography in the evaluation of patients with coronary artery disease? Br Heart J. 1987; 57(4):319-328
- Wirch JL, Wolfe LA, Weissgerber TL, Davies GAL. Cold pressor test protocol to evaluate cardiac autonomic function. Appl Physiol Nutr Metab. 2006; 31(3): 235 – 243.
- Ashwini S, Lingaraj J, Vinita S, Nachal A. Blood pressure response in children of hypertensive and normotensive parents to cold pressor test. Indian J of Physio and Pharm 2004; 48(5):165.
- Verma V, Singh SK, Ghosh S. Identification of susceptibility to hypertension by the cold pressor test. Indian J of Physiol Pharmacol 2005; 49(1): 119-20
- Garg S, Kumar A, Singh SD. Blood Pressure Response to Cold Pressor Test in the children of hypertensives. Online Journal of Allied and Health Sciences. 2010; 9(1):7
- Germano G et al. High Blood Pressure and cardiovascular prevention. 2003; 2(10): 87-90